Step-by-step Guide to Writing a Research Paper in Ecology

Writing is hard. This guide provides advice for writing a research paper (modified from resources on Anna Hargreaves' website).

Before you start

1. Identify your research question(s) and hypotheses.
2. Develop answers these questions using data analysis and figures (although one could write the entire intro and methods before ever seeing results).
3. Read the Content Guideline in full to set your expectations on what to put in each section.

Craft an outline

4. Write an **outline** of the intro, methods, results, and discussion. In this outline, write one sentence that describes what you would say in each paragraph. This represents the topic of each paragraph, and the whole narrative of your paper should come through in these *paragraph topic sentences*. Check the suggested length of each section to set your expectations on this outline, e.g. 3-4 paragraphs for your intro = 3-4 paragraph topic sentences. Now check the content guideline and think about the order of how you want to convey points in these paragraphs.
5. After you have worked out paragraph topic sentences, add in 3-5 bullet points under each one. This will guide your sentences. Keep your bullet points simple; great papers are composed of simple and clear sentences that step in logic.

Draft your paper

6. Turn your outline into a draft. Without adding any extra paragraphs to your outline, turn your bullet points into sentences in the paragraph. **Start each paragraph with a topic sentence.** Topic sentences are probably **the** biggest difference between clear and unclear scientific writing. Tell the reader what you are going to say in this paragraph, and then support or explain this point it in the next few sentences, according to your bullet points. When you are done, check again that you have retained strong topic sentences (sometimes they sneak to the end of the paragraph, but moving them back up to the beginning makes them into sign-posts that your readers will appreciate).
7. To guide your writing, you can keep your paragraph topic sentences in a different colour above each paragraph. This could help you or a fresh reader to check if you are hitting your points.
8. Read, revise, polish, leave, come back fresh. Repeat. Leaving it for a little while can help with a fresh read.
9. You don't need to go in order: the outline should help, but it is sometimes helpful to finish your paper from inside out, e.g. start with methods, then results, then move to introduction and discussion. However, you won't go far without a clear question and hypotheses, so jot those into the intro section either way.

General writing tips

Language:

- In general, use simple terms instead of more complex ones, use words according to the precise meaning understood by the average person.

Aim for economy by removing access words. Here are some examples:

- *because* instead of ~~*based on the fact that*~~*;*
- *for* or *to* instead of ~~*for the purpose of*~~*.*
- ~~*there were*~~ *several subjects* ~~*who*~~ *completed…; <- avoid building nouns when subjects are better*
- ~~*it is suggested that*~~ *a relationship may exist…;*
- ~~*a total of*~~ *n subjects;*
- *four* ~~*different*~~ *groups;*
- ~~*absolutely*~~ *essential;*
- *found* ~~*previously*~~*;*
- *small* ~~*in size*~~*;*
- *in* ~~*close*~~ *proximity;*

Flow:

- generally work from big ideas to small, general to specific, and keep ideas blocked into groups
- Arrange sentences so that a reader gets the key information earlier in the sentence.
- Avoid too many direction changes in arguments. E.g. Don't use *however* or its synonyms twice in one paragraph. Changing the direction of an argument twice in one paragraph is hard for readers
- Don't use a long string of qualifiers in front of a noun: e.g. 'a modified test of cognitive function' is better than ~~a modified cognitive function test~~.

Logic:

- For each sentence you write, does the statement stand on its own?
- In the introduction, provide a logical justification for your question and expectations, without jumping steps. E.g. not: Biodiversity could be important for climate change resilience -> How does biodiversity change across habitats types? There is a step missing. We know the topic is in general important but we don't know why the question is important to answer.
- Give evidence for each assertion, particularly in your discussion.
- Avoid overgeneralizing or over simplifying.

Paragraphs should:

- Focus on a single, cohesive idea
- **Start with a topic sentence** that tells reader what the paragraph is about. This sentence must be broad enough to cover the entire paragraph, and should link or flow from the preceding paragraph. However this sentence should stand on its own. Don't make readers refer back to the previous paragraph to know what your topic sentence is about (eg don't start paragraphs with unexplained 'These...').

Sentences should:

- Be as concise and clear as possible
- Vary in length
- Be reordered and reduced to be as clear as possible. (check pages 4-9 in the Scientific Writing Booklet for **great** suggestions to look out for).

Signposting and internal order:

- The goal of good writing is to make your reader's life as easy as possible by making your arguments and paper easy to follow and concise.
- That includes lots of *signposting* – telling them what's to come, reminding them of points already made, making it easy to follow where predictions come from and how results relate to them.
- If you have more than one question that you are asking, keep the same order of topics in the intro, methods, and results. Refer to these with the same terms – now is not the time for alternative ways of describing the question or the hypothesis, using the same terms helps signpost each step.
- You can use signposting within sections. E.g. The first paragraph of the discussion could include a quick outline of what is to come.